SPARK

REPORT

STRATEGIC
PLANNING
FOR
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RESEARCH
AND
KNOWLEDGE

Science
Council of
British
Columbia

SOFTWARE PRODUCTIVITY CONSORTIUM

NEEDS ANALYSIS

PRELIMINARY RELEASE

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by

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MACDONALD DETTWILER

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ACRONYMS AND ABBREVIATIONS

MDA	MacDonald Dettwiler
NRC	National Research Council
SC	Science Council of British Columbia
S/W	Software
SE	Software Engineering
SEI	Software Engineering Institute
SPC	Software Productivity Consortium

SECTION ONE

EXECUTIVE SUMMARY

The Science Council of B.C. (SC) and MacDonald Dettwiler (MDA) have conducted a survey of the software industry in B.C. The project was sponsored by the SC, MDA and the National Research Council (NRC). The purpose of this project is to investigate the potential for establishing a Software Productivity Consortium (SPC) in this province.

Software productivity has a direct bearing on profitability and the competitive edge of a software company. However, other aspects such as quality are equally important. Therefore the scope of this survey goes beyond productivity and embraces all relevant facets under the general concept of software engineering.

This report summarizes the results from 17 companies which were included in the survey. Quantitative as well as qualitative results are documented.

The survey concludes that although many companies have an acceptable understanding of software engineering concepts there is significant room for improvement. This judgement is based on comparison at an international scale. About 80% of all surveyed companies export their products. The report defines a package of specific services to improve profitability and the competitive edge of the B.C. software industry.

Most industry representatives expressed strong interest in the concept of the Software Productivity Consortium. In particular there appears to be a real need for a central agency facilitating the exchange of information and experience between large and small companies within the industry at a provincial level. At a more global level the Software Productivity Consortium could play the role of information conduit between the B.C. Software Industry and the international community. In summary this report recommends to proceed with a business plan for the proposed Software Productivity Consortium.

SECTION TWO

ACKNOWLEDGEMENTS

This study was made possible by the sponsoring agencies:

- Science Council of BC
- National Research Council
- MacDonald Dettwiler

Valuable support was obtained from the participating companies and their representatives:

MPR	Ian J. Dowdeswell Vice President
Glenayre	Gary B. Smith Director, Engineering
MDI	Willie Wang Manager, Engineering
Soft Set	W.J. Campbell President
Richmond Software	Tom O'Flaherty President
Quilchena	Toni Copping President
Pamap	Dr. Pamela Sallaway President
MDA	Peter George Director, Engineering
DSI	Dr. Karl Brackhaus President and CEO
Sierra	John Bovard Partner

Chancery	Dave Reback President
Epic Data	Duncan Smith Director, Product Development
DDS	Vari Ghai President
Kustom Electronics	Vari Ghai
B.C. Tel	George Kawaguchi Q.A. Manager
Westech	Raymond Tang Manager of Development Centre
Distinctive Management Group (DMG)	Bruce McMillan Vice President, Operations

A specially established taskforce was instrumental in guiding and reviewing the process:

Mr. W. J. Campbell	Softset
Mr. Ian Dowdeswell	MPR
Mr. Nick Fong	NRC
Mr. David Hughes (Chairman)	Sierra
Dr. ann levi-lloyd	BC Science Council
Dr. Hausi A. Muller	UVIC
Dr. Pamela Sallaway	Pamap
Mr. Ross Senior	CATA
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Dr. Denis Connor	SCBC, President
Mr. Ian Howard	Ian Howard & Assocaites
Dr. ann levi-lloyd	Who commissioned the study on behalf of the SCBC

SECTION THREE

OBJECTIVES

The software industry is probably the fastest growing major new industry in British Columbia. The industry has grown to over 250 companies in the province and an annual growth rate of nearly 50% is expected. Most companies have been in business for less than 6 years. The majority of these firms employ less than 10 people. As the software industry is becomingincreasingly capital intensive many of those young and growing companies face critical hurdles in acquiring the knowledge and tools required to maintain their competitive edge.

The idea of providing assistance to industry through a central agency has been successfully implemented elsewhere. In 1986 the Software Productivity Consortium was established in the USA. It is funded through membership of major US corporations. It's mandate is to develop tools and techniques to improve software development productivity. In Canada, the Aerospace Industries Association of Canada (AIAC) has created a productivity committee which acts as a catalyst to improve productivity in that industry.

The objective of the current study is to perform a needs analysis in the B.C. Software industry. The goal is to establish if there is a perceived need for the proposed SPC. Ideas and recommendations for potential services were solicited from the survey participants.

The findings of this industry survey are summarized in this report. Recommendations for further action are provided.

SECTION FOUR

SCOPE

This study focuses on the software development industry. This spans a wide range of applications and includes companies which conduct software development as part of their overall activities. The needs analysis concentrates on the technical aspects of software development and the tools and services required for this activity. The project is concerned with all industrial regions within the province with special emphasis on the lower mainland of Vancouver and Vancouver Island. Special effort was made to consult with various interest groups and industry associations. The surveyalso obtained input from the educational sector.

SECTION FIVE

SURVEY METHODOLOGY

Given the purpose of this survey it was important to establish personal contact with as many industry experts and company representatives aspossible. On the other hand an objective profile of each company's softwaredevelopment activities was essential to categorize the various industry segments. As a result four basic approaches were taken to gather data and input for this report.

1. TASK FORCE

Significant input to the survey methodology was obtained from the task force. This group was scheduled for three meetings over the duration of this project. At the first meeting the methodology and the questionnaire were reviewed. A list of selected companies in the software industry was established and categorized into four groups (see appendix B). From each group representative companies were then selected for the survey. The objective was to limit the survey to about 20 companies as the budget for this project necessitated some down selection. At the same time an even distribution of industry representatives over all categories was attempted. At the second and third meeting preliminary results were reviewed and recommendations for the final report were made.

2. QUESTIONNAIRE

As a first step a questionnaire was mailed to the participating companies (see Appendix A). The questionnaire was derived from work performed at the Software Engineering Institute (SEI) at Carnegie Mellon University [HUMP, 87]. The SEI had developed a survey instrument to categorize S/W Engineering proficiency. The SEI questionnaire was condensed significantly and modified to suit a wider range of suppliers. Additional questions were added by the author to cover the overall objective of this study.

Prior to mailing the questionnaire a spokesperson for each company was contacted by phone to introduce the purpose of the study and to arrange for a personal meeting with the author.

3. INTERVIEWS

It was felt important to collect ideas and comments from the survey participants beyond the data that could be collected with the questionnaire. The author visited each company representative for a one hour interview. At this meeting the replies to the questionnaire were reviewed to avoid any misinterpretations. Further input about industry needs and the general interest in SPC was obtained in a subsequent discussion. This part of the interview proved to be most useful and many of the ideas summarized in the final recommendations surfaced in these discussions.

4. USER GROUPS

Presentations of the SPC concept were made to three user groups:

VITRA:	Vancouver Island Technology Research Association
BCS:	British Columbia Software Association
IEEE:	Institute of Electrical and Electronics Engineering, Computer Society

The presentations were followed by questions and discussion. This process helped to gain wider exposure of this survey and yielded valuable input.

SECTION SIX

COMPANIES SURVEYED

All contacted companies with the exception of two agreed to participate in the survey. Confidentiality of information is maintained by this study. All data (except for company size) is averaged and listed by category only. Companies are categorized in a 2-dimensional matrix. The first dimension groups companies by the number of staff employed in a software development related function. (Note that for most companies this is less than total company staff). The grouping by size is as follows.

# of S/W Related Staff	Size Category	Number Surveyed
150+	A	5
40 - 149	B	5
10 - 39	C	4
1 - 9	D	3

Size category D includes small companies in which informal communicationis still possible. This was typically cited as reason for little formality. Category C includes companies which have outgrown the start-up phase and encounter the first challenges of controlling a process which is controlled by more than one manager. Categories B and A represent medium to large software development companies with many projects underway simultaneously.

The second dimension groups companies into categories of software development activity:

Type of S/W Development	Category	Number Surveyed (1)
System Integrator	SI	6
S/W Product developer	PD	8
Embedded S/W systems	ES	8
Internal MIS development	MIS	3

(1) Note that some companies are listed in more than one category.

The SI category includes companies which integrate their developed S/W into hardware systems. The final product is typically a turnkey system. SI companies are characterized by low volume, highly specialized systems. Software product developers in the PD category develop software packages as their end product. This group is characterized by carrying relatively few products but high sales volume for each of their products. Embedded S/W systems are defined as software products which become integral part of a hardware device. Frequently the software is stored as firmware within the device. Sales volume is relatively high for each product line. Finally the MIS category includes companies which develop S/W applications for their own MIS department. In this case S/W is developed for internal use only.

Several of the larger companies fall into more than one activity category. Appendix C maps all surveyed companies into the 2 dimensional classification system.

SECTION SEVEN

SURVEY RESULTS

Results from this survey contain quantitative data as derived from the questionnaires and qualitative information as obtained from the interviewer.

A high degree of software productivity is only one of the factors which distinguish software development companies in the very competitive global market place. For this reason the survey has included other considerations such as quality, reliability, maintainability, etc. All of these factors are directly affected by the overall software engineering process [Boeh,81]. One definition of Software Engineering (SE) which covers most of its aspects came from the Software Engineering Institute:

> "The disciplined application of engineering, scientific, and mathematical principles and methods to the economical production of quality software" [HUMP, 89].

For the remainder of this study the principles of software engineering will be used instead of the more narrow definition of software productivity.

7.1 S/W ENGINEERING PROCESS EVALUATION

The questionnaire contained 35 YES/NO questions to establish the degree to which commonly accepted software engineering practices are used. The degree to which these practices are used is also called the software engineering proficiency. This includes, among other things, the awareness of SE issues and the ability to effectively deal with those issues. A word of caution is necessary as several factors can distort the results obtained. To obtain a well calibrated view of the degree of S/W engineering practices used the full SE questionnaire would need to be applied. In addition one to ten people (depending on company size) would need to be interviewed to eliminate personal biases and get a balanced view of software engineering proficiency. However, the results are viewed as relevant since the purpose was not to establish an absolute measure of proficiency but to obtain datarelative to the sample group.

7.1.1 DISCUSSION OF RESULTS

Table 1 shows the relative degree of S/W proficiency by category. There is a total of 35 questions on SE methods. The percent of positive (YES) answers is listed in the table. A score of 100% would indicate high proficiency while a low percentage shows the opposite. Figure 1 shows the graphical interpretation of results grouped by company size. Details of the results for all companies are listed in Appendix D.

Company groups are well differentiated by the size categorization. Large companies tend to have larger contracts which necessitate a higher degree of standardization. The organizational structure and the complexity of communication channels caused by many projects and departments tends to create the need for more controlled procedures. At the other end of the spectrum the small firms have straight forward communication channels and less need for formalization of the SE process. A frequently mentioned reason for low formality in small companies was the limited amount of financial resources for overhead activities. This opinion raises some concern since it is a well established fact that the overall cost of software development is reduced by a structured and formal approach.

7.1.2 QUALITATIVE ASSESSMENT OF RESULTS

The scores in Table 1 are relative to a simplified version of the original SEI questionnaire which contained over 100 questions. Two of the highest ranking companies in this survey were evaluated with the original questionnaire and they only obtained a ranking of 60-70%. This shows that in comparison to world wide competition the B.C. software industry still has considerable room for improvement.

In the author's opinion the spread between the highest and lowest ranking companies is actually larger than the numbers would indicate. At the high end of the scale companies are well aware of existing methodology and the technical managers interviewed tend to be very self critical. At the other end of the scale the interviewers often were not fully aware of the state of the technology and tended to give overly optimistic answers.

Many of these discrepancies were identified during the personal interviews but the scores were not adjusted without the consent of the interviewee. An exact reading of a company's proficiency can only be obtained with a thorough audit which was beyond the scope of this survey. The interviews did however show that most B.C. software companies need considerable improvement in their approach to software engineering if they want to compete successfully in the global market place.

Of particular concern is the relatively low ranking for small companies and those in the product development (PD) category. If the products aretargeted for a protected niche market the companies may be able to dictate the price of their product and to survive some quality defects. However, most software products today are compared with similar products from the US, Europe or the Pacific Rim countries. In those cases software productivity and quality are essential for the company's success if not crucial for its survival.

Many of the larger companies have gained experience in introducing methodologies and productivity enhancement tools without stifling the creativity of their employees. Small to medium size companies have not yet started this process or are struggling with it. This is an area where theSPC could provide valuable help as an agent of cross-fertilization in the local software industry.

TABLE 1

SOFTWARE ENGINEERING PROCESS EVALUATION

By Size

Category	Percent YES Answers
A. 151+	81.1
B. 41 - 150	71.4
C. 10 - 40	69.4
D. 1 - 9	45.7

By Activity

Category	Percent YES Answers
SI	77.6
PD	60.0
ES	70.4
MIS	86.7

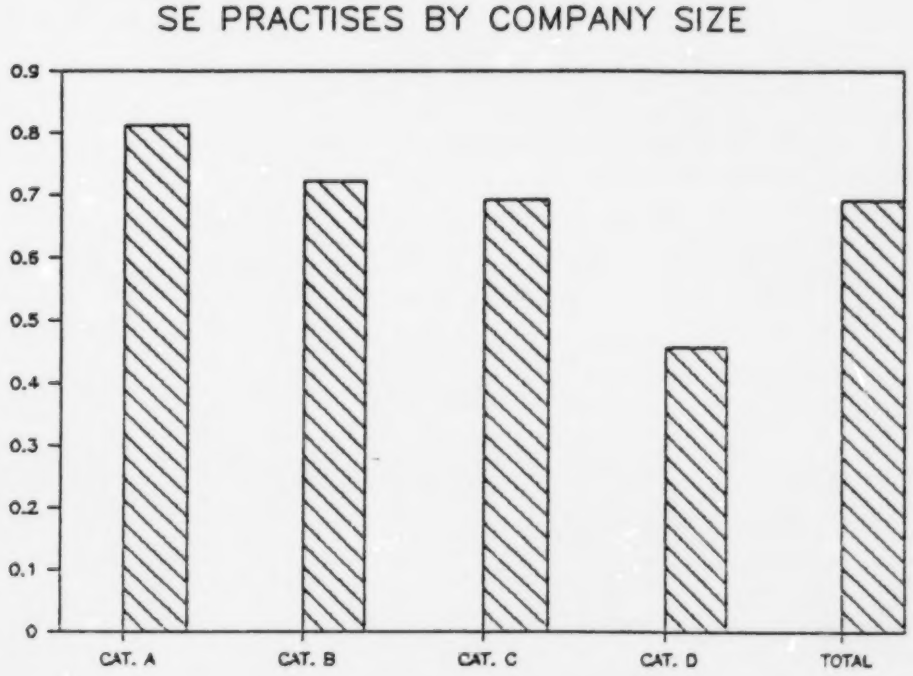

Figure 1

Level of Software Engineering Practices Employed

7.2 PRIORITIZATION OF DESIRED SPC SERVICES

Seven choices were presented as potential services rendered by the SPC. Each service was reviewed and explained during the interview sessions to ensure correct interpretation.

Tools:	Computer assisted S/W engineering (CASE) tools. A. The SPC would act as a broker to facilitate access to tools developed in the local industry (incl. commercialization of tools). B. SPC would survey tools and suppliers and recommend qualified tools.
Training:	Training courses in S/W development related areas. The SPC would give training or arrange for local courses at favourable fees.
Technology:	The SPC would organize technology seminars. Upon request the SPC would survey a specified technology segment on behalf of one or several companies. This includes liaison with Universities and other consortia.
Consultation:	The SPC would maintain a list of qualified specialists and act as referral service. When possible the SPC staff would provide consulting services.
Staffing:	The SPC would help in the recruiting process at a provincial, national or international basis.
Marketing:	This service is not perceived as within the mandate of the SPC. The question was asked to see if there was significant interest in this area and to ensure that the technical focus of the SPC does not miss a dominant need within the industry.
Finance:	Same comment as for marketing.

7.2.1 Discussion of Results

Table 2 lists the overall ranking given to each of the offered services, and Figure 2 shows the same data graphically. (Note that the questionnaire assigned #1 to the highest priority and #7 to the least desirable service). To discuss the particular meaning of these results in more detail the responses were grouped into the four categories of company size.

Figure 3 shows the interest in services as expressed by large companies (Group A). There is no strong discrimination of interests except for consulting and finance which scored low. Large companies generally are quite self-sufficient and have access to many services within their organization. On the other hand they displayed a very positive outlook towards the proposed SPC. This is very encouraging since it shows that the SPC will be able to count on the participation of large organizations which in turn will benefit the medium and small companies.

Figure 4 shows the results for medium to large companies (Group B). Here a very clear ranking of interest is apparent. Tools and training stand out raising the highest level of interest. For the first five service items this group is generally in line with the overall results of the study.

Results for medium size companies (Group C) are shown in Figure 5. Putting aside the results for marketing and finance we can see that there is a keen interest in staffing these organizations. This could be related to the fact that these companies are in a strong growth phase and do not yet have the experience of larger organizations in sourcing their personnel.

Finally the results for small companies in Group D are shown in Figure 6. The interest in marketing and finance is striking but not unexpected. Staffing is not a problem since the few people needed are usually handpicked by the owner. While tools and training obtain similar scores as in larger companies there seems to be higher interest in consulting services.

The priority ranking for desired services is a good match with the weaknesses that the survey identified. Software engineering and related tools and techniques are rapidly evolving. A collection of practical documents describing the software development steps for each phase of the process and systematic training of all staff in generally accepted principles of software engineering is a simple but effective recipe for improving quality and productivity. The SPC could develop or adopt a generic set of such documents and related training programs. If this was done in a competent way the SPC could offer a significant leverage from such a program to the general B.C. softwareindustry. Recommendation of existing tools or development of new tools could lead to a software "tool box" which would be compatible with the methodology and training package.

The coordination of presentations by prominent speakers on new or emerging technology trends and other services to facilitate access to leading edge technology (such as memberships with other consortia) would maintain the competitive advantage of the local industry.

Of course the above approach does not guarantee a leading position in the software industry. As B. Boehm's research shows, the key factor for success still lies in the people we use. The SPC can help in some staffing activities but as most surveyed companies rightly observed, the responsibility for the staff selection remains with each company.

TABLE 2

PRIORITIES FOR SUGGESTED SERVICES

SERVICE	PRIORITY	RANK
Training	1	2.8
Tools	2	3.2
Technology	3	3.8
Marketing	4	4.1
Staffing	5	4.4
Consulting	6	4.8
Finance	7	4.9

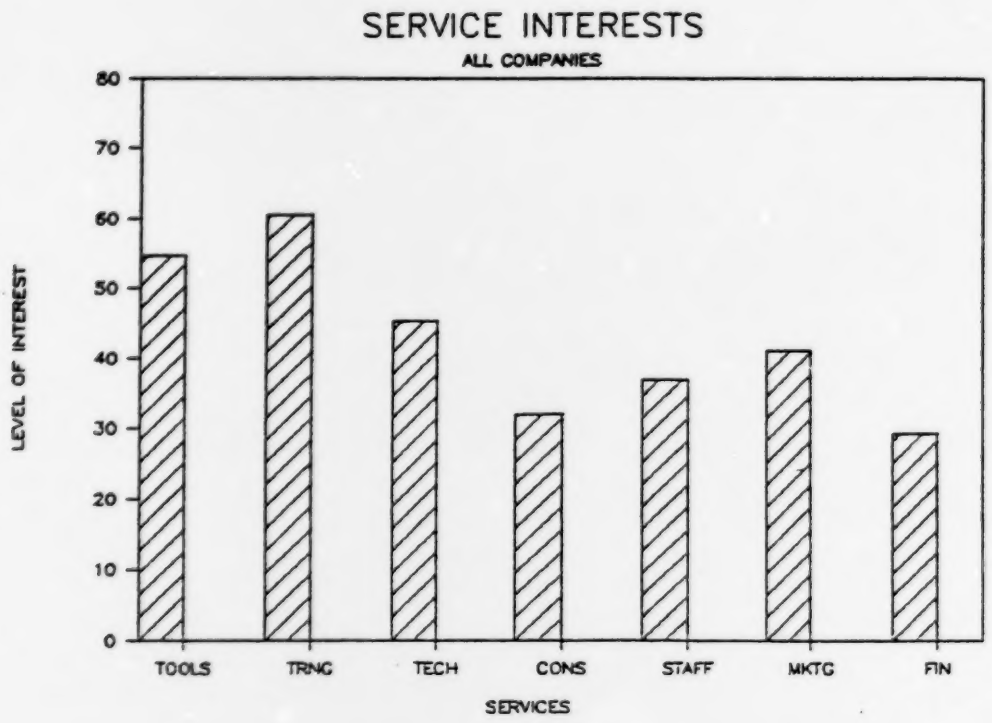

Figure 2

Average in all Companies

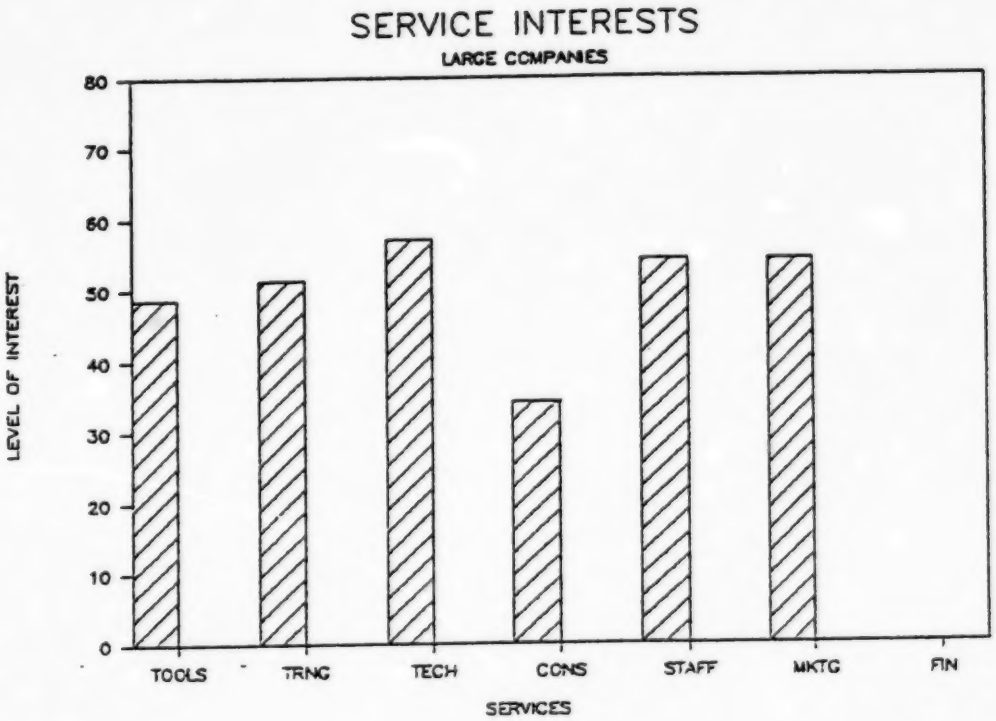

Figure 3
Companies in Category A

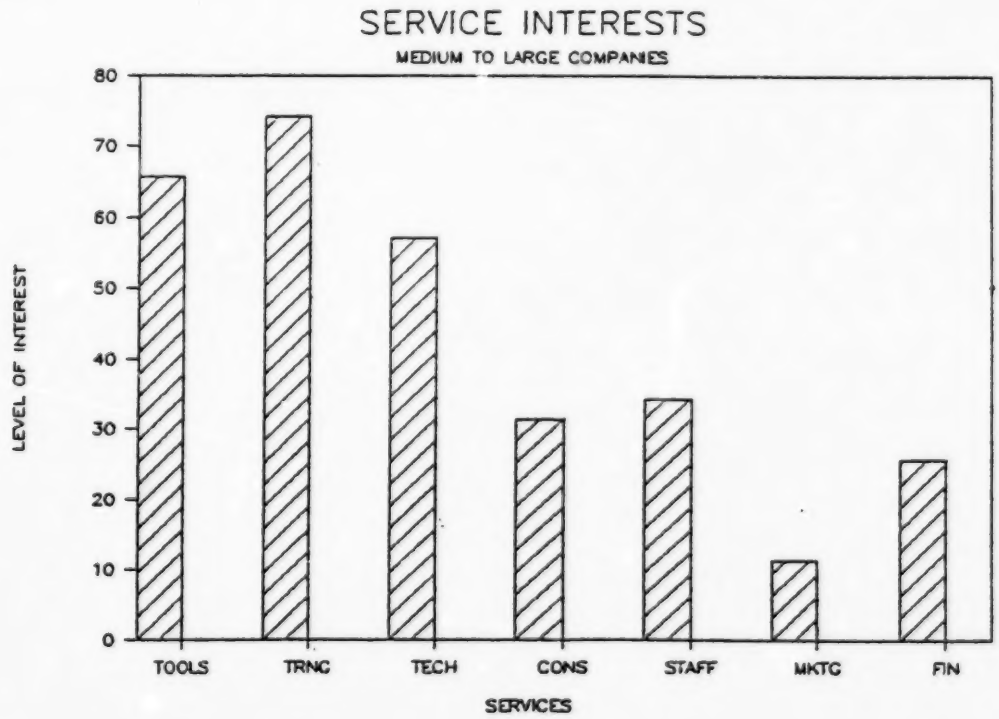

Figure 4
Companies in Category B

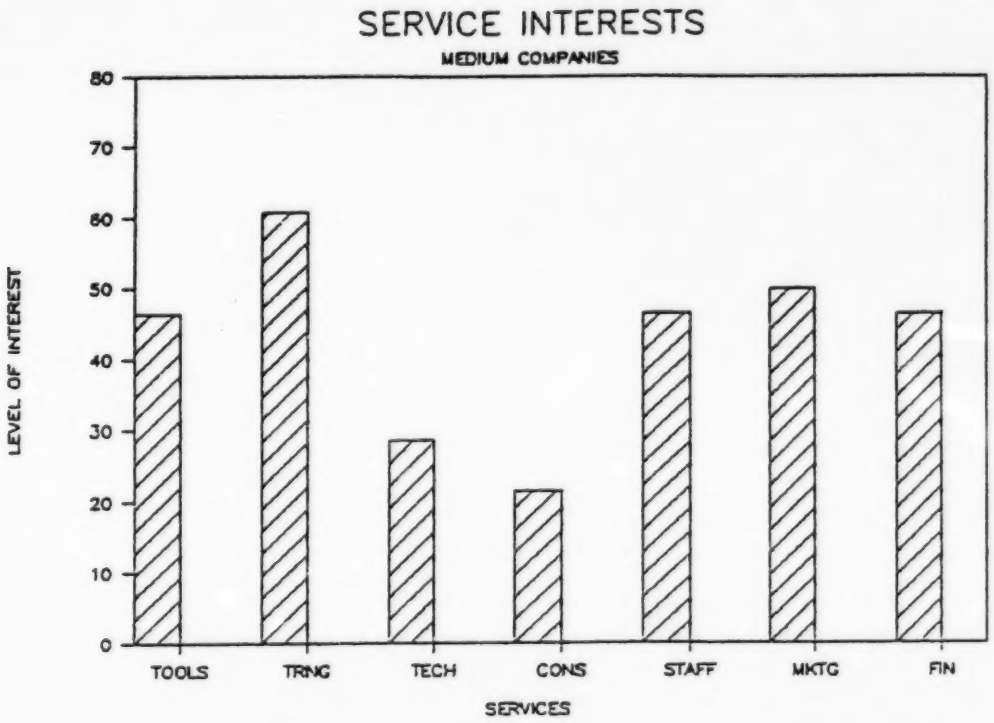

Figure 5
Companies in Category C

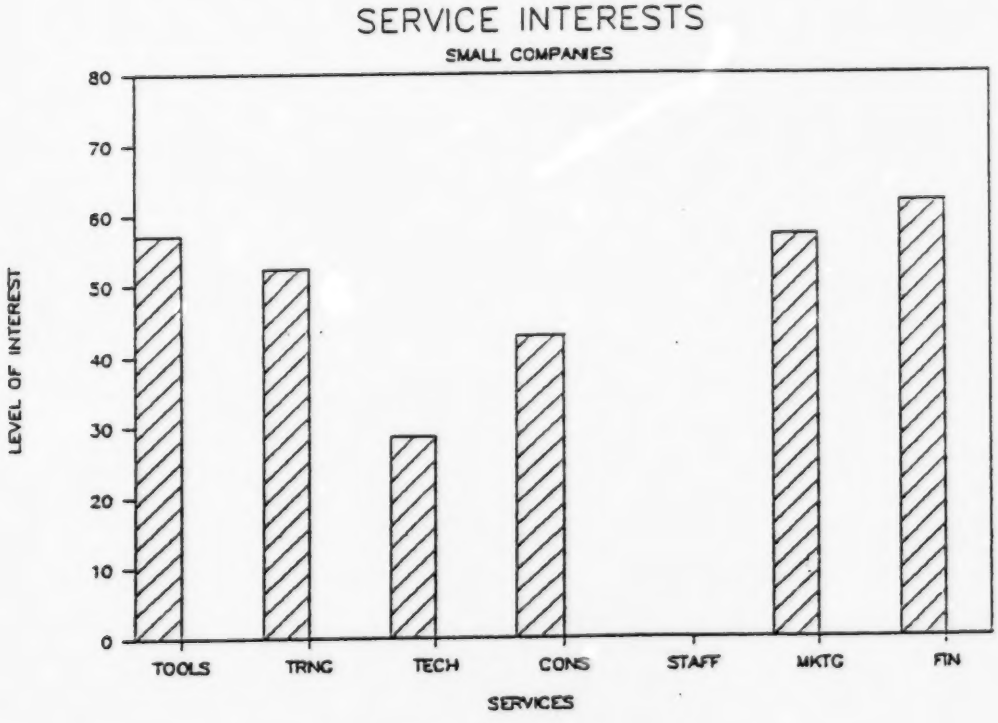

Figure 6
Companies in Category D

7.3 INTERVIEW COMMENTS AND SUGGESTIONS

This section is derived from notes taken during the interviews. Additional suggestions from industry experts and task force members as well as user groups are included.

Without exception the author was very well received by all company representatives. The general level of interest ranged from non-committal to very interested. Obviously there is a problem to solicit strong interest on the basis of a paper concept. Most people had a wait-and-see attitude. It is clear that the SPC would have to offer a high level of expertise and quality service in order to succeed. Respondents tended to be reluctant to talk too much about their needs in technical expertise as this might lead to negative inferences about their own capabilities.

Many small companies were more interested in general business assistance (marketing, finance) than in improving the procedural aspect of managing their approach to S/W development.

This section will list all comments in bullet form in no particular order. The comments are a valuable collection of ideas gathered throughout this survey. It is hoped that they will provide input to those who will be given the mandate to make the SPC a successful operation. In Section 8 some of the most promising ideas are used in formulating recommendations for initial services.

- Could use help in evaluation and selection of CASE tools.
- Interest in complementing university education with industry oriented training for new graduates.
- Would normally not take the initiative to seek assistance from SPC. It would be SPC's responsibility to promote services proactively.
- All companies, large and small, have to participate to make SPC a success.
- S/W engineering is not a well understood discipline. Start out with simple goals (and successes) before setting expectations too high.
- 90% of company success depends on the people it employs (i.e. only 10% on tools and methods).
- Only guarded interest. Concerned about SPC taking the flavour of data gatherer, administrator as opposed to a very knowledgeable expert organization.
- Host a major computer conference in Vancouver or Victoria. Encourage subcommittee meetings in B.C. (e.g. IEEE, CIPS, AIAC meetings)
- Seminars on general state of the technology would be very useful for the "working manager".

- Interested in seminars on real life industry experience (given by industry representatives).
- Need to teach people how to run a business, not how to do research (favoured marketing and finance assistance).
- Establish a local network service for recruiting purposes.
- Publish a newsletter.
- Need more details about services offered, quality and cost of services.
- Help local industry to share resources to smooth out fluctuations in work load.
- Share costs for recruiting, advertising, salary surveys.
- Present a common industry view and influence curriculum of educational institutions.
- Access to a variety of computing equipment would be of interest.
- Help sift through the wealth of literature and condense and present information on demand.
- Establish special interest groups.
- Interested in sharing training to reduce cost.
- Interested to provide consultants via SPC referral.
- Establish an electronic bulletin board.
- Interested in assistance for grant applications.
- Offer a service to certify viability of proposed project. This could then be used to apply for bank financing, especially if the certified proposal was backed by government guarantees.
- Provide help in producing quality manuals (possibly adhering to specified standard).
- Stay very focussed and specific to maintain efficiency and credibility.
- Assist in moving across specific technology hurdles (e.g. move from DOS to UNIX).

- Assist companies to become qualified as DND supplier or as subcontractor to larger companies.
- Consortium might not be the right name, prefer "Center".
- Number 1 concern of small companies is survival, not procedures.
- Help in S/W project cost estimates.
- Help to establish better contact between universities and industry.
- Make SPC part of ASI.
- Help companies to save time (their most valuable resource).
- S/W methodology is like religion and the SPC should stay away from getting entrenched in any camp.
- Assist engineering manager's to make their case for improved methodology towards senior management. Raise the awareness of senior managers.
- Interest not only in CASE tools but also project management tools.
- Creation of on-line Engineering Handbooks.
- Help in general networking (establishing industry contacts).
- Distinct concern not to spend too much time helping companies which have a questionable basis on which to build a business. This leads to the important issue of how to allocate effort to ensure optimal return to the economy.

SECTION EIGHT

RECOMMENDATION

This survey has shown that the B.C. software industry as represented by the surveyed companies could benefit significantly from the services of the SPC. The current state of technology and expertise is generally good but it needs to be improved to maintain its market share in a global market place. The comparison on an international scale is inevitable since 78% of the surveyed companies export their products.

In general there was substantial interest in the creation of the SPC. It is difficult to assess the ultimate industry commitment to a service until it is established and until it can show exactly what it has to offer. Key to its success will be the people employed by the SPC.

As mentioned by several respondents it will be essential to start out small and very focussed to gradually establish a reputation. Significant effort will have to be put into promotion and constant contact with the industry to gain visibility. On the other hand any over commitment must be avoided to prevent unmet expectations - a delicate balance.

To establish a successful basis in which to launch the SPC some very specific and focussed services need to be offered. Over time the quality of services rendered will create a demand level which is sufficient for sustained operation of the Software Productivity Consortium. Suggestions for these services include:

- coordinate training activities
- offer assistance in the selection of CASE tools
- offer assistance in the preparation of chapters for methodology (procedural) manuals
- publish a newsletter
- establish an electronic bulletin board
- provide assistance for companies to overcome hurdles in their growth (this may be a mix of technology and management consultation)
- offer a service to assess and certify the technical feasibility of S/W products with BC government backing.

As discussed in section 7.2.1 these services could be grouped into an effective package. Once this package is developed the initial investment could be leveraged into the repeated application (with minor customization) throughout the local software industry. A similar concept has been implemented for many years by the Japanese Ministry for Industry and Trade (MITI) with significant and well publicized success. I do not see any reason why B.C. could not obtain similar results.

To provide a responsive quality service and simultaneously attend to the need for industrial relations and promotions the author suggests that the SPC starts out with an initial full time staff of two professionals and the part time assistance of one secretary:

Director of SPC: General management, promotion and industry/educational sector relations. A knowledgeable person in many industry sectors as well as in S/W engineering.

Technical Expert: An expert in S/W engineering with a broad experience basis. A hands-on "fire-fighter", whose enthusiasm is fueled by the variety of technical challenges.

It is suggested that funding for the first year is obtained through government assistance. During the early stages it would be difficult to meet the obligation for financial self sufficiency and to simultaneously establish a credible service for the industry at large.

In subsequent years the government funding should be gradually reduced with a goal to become self sufficient within the first three years of operation. In summary this means that the SPC would have three years of guaranteedfunding which is composed of Government and Industry contributions.

A review board consisting of representatives from industry and the sponsoring organizations should be established. This board will be responsible to review Software Productivity Consortium activities on a quarterly basis and to approve annual budgets and business plans.

Several organizations have already expressed a keen interest in accommodating the SPC on their premises. Suggestions include:

- UVIC campus, Victoria
- ASI facilities at UBC
- SFU downtown campus

In the opinion of the task force it would not be desirable to co-locate the SPC at one of our educational institutions. To be successful the SPC will have to be industry oriented. While it would likely collaborate with Universities and Colleges in developing its programs it should not be perceived as an extension of academica.

Organizational issues such as location of the SPC will be considered in the business plan.

APPENDIX A

QUESTIONNAIRE

A SOFTWARE PRODUCTIVITY CONSORTIUM FOR BRITISH COLUMBIA

Have you ever asked yourself these questions:

- Are we really exploiting our full potential for productivity?
- Do we know how to do it?
- Are we able to follow all industry trends to pick those which are the best for our company?
- Do we have time to stay current?
- Which CASE tools should we buy?

Answers to these and many other questions become increasingly important in our industry. In addition, the same questions are analyzed simultaneously in most of the 250+ companies involved in software development in British Columbia. These duplications are a waste of energy which could be deployed more effectively in developing our products. The competitive edge of our industry could be increased significantly if an independent organization had the mandate to worry about these questions and share the results with the industry.

This is the kernel of the idea to launch a project which explores the usefulness of creating a Software Productivity Consortium. Its mandate would be to deal with those questions, facilitate the distribution of local products within B.C. and help in acquiring relevant knowledge. It is often said that the software industry in B.C. has reached "critical mass" but as we know from nuclear physics, critical mass has no effect if it exists in form of disconnected particles. If brought together, the products and ideas of the industry should turn into a significant increase in productivity.

As a first step the Science Council of B.C. will conduct a survey of the B.C. software industry. The survey is co-sponsored by MDA and the National Research Council. The objective is to explore the needs of firms involved in software development. It will assess if a business case can be made to establish a Software Productivity Consortium in the province.

The study is conducted by Wolfgang B. Strigel and will produce a recommendation by early March 1990.

As the project will also set up a task force on this topic. Any suggestions are welcome and should be directed to:

Wolfgang B. Strigel
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General Company Information

Note re Confidentiality:

All information obtained from this questionnaire or from the personal interview is strictly confidential. Results will be summarized in such way that no relationship with the participating companies can be established.

Is your head office in B.C.? Yes _____, No _____

Number of offices in B.C. _____, Canada _____

U.S. _____, Elsewhere _____

Number of staff in B.C. _____

Number of staff involved in S/W (1) development (professional & support) _____

Percent of total company revenue from S/W products and services _____%

Total annual revenue projected for current year (optional) $ _____

(1) S/W = Software

Market Information

Please identify all target markets and/or areas of application for your products and services:

Application		Application	
_____	Scientific	_____	Process Control
_____	Accounting	_____	Communications
_____	Banking	_____	Expert Systems
_____	General Business	_____	Project Management
_____	Education	_____	CAD/CAM
_____	Engineering	_____	Databases
_____	Health Care	_____	Graphics
_____	Legal	_____	CASE tools
_____	Manufacturing	_____	Statistics
_____	Retail	_____	Networks
_____	Transportation	_____	E-mail
_____	Government/Defense	_____	Window Systems
_____	Government/Other		
_____	Consumer Market		

Development Languages Used

_____ Ada	_____ Fortran	_____ RPG
_____ Assembler	_____ Lisp/Prolog	_____ Prolog
_____ Basic	_____ Modula	_____ Smalltalk
_____ C	_____ Pascal	_____ C ++
_____ Cobol	_____ Proprietary	_____ Postscript
	_____ PL1	_____ Other

Percent use of _____ % high level language

_____ % Assembler

Type of S/W (rate as % of total S/W activity):

Standalone packages (1):	_____	PC or Workstations
	_____	Mainframes
Embedded software (2):	_____	
Total	100%	

(1) Software packages (programs) sold as products of your company.

(2) Software which is an integral part of other equipment (eg. a rapid transit system).

The Software Engineering Process

(Please circle "yes" if the statement is true for more than 80% of all instances, "no" otherwise.)

1.1	• Is there a software configuration control function?	YES	NO
1.2	• Is there a software process or methodology group?	YES	NO
1.3	• Is there a software Quality Assurance (SQA) function?	YES	NO
2.1	• Does each S/W developer have a private workstation or terminal?	YES	NO
2.2	• Is there a required training program for S/W developers?	YES	NO
2.3	• Is there a required training program for design and code reviews?	YES	NO
3.1	• Is a mechanism used for maintaining awareness of the state-of-the-art in S/W engineering?	YES	NO
3.2	• Is a mechanism used for evaluating technologies used by the organization versus those externally available?	YES	NO
3.3	• Is a mechanism used for identifying and replacing obsolete technology?	YES	NO
4.1	• Does the S/W organization use a standardized software development process (methodology)?	YES	NO
4.2	• Is this process documented?	YES	NO
4.3	• Is there a document to describe the use of tools and techniques?	YES	NO
4.4	• Are there periodic management reviews of the status of S/W projects?	YES	NO
4.5	• Is existing design and code typically considered for reuse in new applications?	YES	NO
4.6	• Are coding standards applied?	YES	NO
4.7	• Are design and code review standards applied?	YES	NO
4.8	• Are documentation standards used?	YES	NO
5.1	• Are S/W size estimates generated?	YES	NO

(Please circle "yes" if the statement is true for more than 80% of all instances, "no" otherwise.)

5.2 • Are procedures or models applied to estimating S/W development costs?	YES	NO
5.3 • Is software productivity analyzed for each major process step?	YES	NO
5.4 • Are error statistics kept and reviewed periodically?	YES	NO
5.5 • Are estimates generated about amount of potential "bugs" remaining in the product?	YES	NO
6.1 • Are formal design and code reviews conducted?	YES	NO
6.2 • Are action items resulting from reviews tracked to closure?	YES	NO
6.3 • Is there a mechanism to control changes to the design?	YES	NO
6.4 • Are software problem reports monitored until complete resolution of the problem?	YES	NO
6.5 • Are first-line managers asked to commit to schedule and cost estimates before work begins?	YES	NO
6.6 • Are formal test plans generated?	YES	NO
6.7 • Is regression testing performed routinely?	YES	NO
6.8 • Does the design include a section for user interface considerations?	YES	NO
7.1 • Are formal design notations such as PDL used in S/W design?	YES	NO
7.2 • Are computer tools used to assist in tracing requirements to S/W design?	YES	NO
7.3 • Are tools used to analyze software complexity?	YES	NO
7.4 • Are interactive source-level debuggers used?	YES	NO
7.5 • Are maintenance tools used?	YES	NO

To help in assessing the feasibility of a S/W Productivity Consortium (SPC) we would like to know what services and other help would be of interest to you. Please consider the following options provided by the SPC and indicate your interest.

Option	Interest		
	High	Med.	Low
1. S/W Development and Productivity tools (CASE)			
a) Commercialization and distribution of industry developed tools (including your own)	____	____	____
b) Industry sponsored development of tools	____	____	____
c) Acquisition of available tools and industry sharing on a "rent-a-tool" basis	____	____	____
2. Training			
a) Development of S/W engineering courses	____	____	____
b) Coordination of commercially available courses to obtain group discounts	____	____	____
c) Seminars re state-of-the-art technology	____	____	____
3. Access to most recent developments in S/W technology			
a) Associate member of international consortia	____	____	____
b) Exposure to development in standards	____	____	____
c) Sharing of locally developed procedures and techniques	____	____	____
4. Consultation (technology, methodology, project management)			
a) Specialists employed by the Consortium for consultation services to the local industry	____	____	____
b) "Brokerage" of specialists from local industry	____	____	____
c) Independent project reviews or audits	____	____	____
d) Independent test and verification	____	____	____

Option	Interest		
	High	Med.	Low
5. Staffing			
a) Pool of technical experts available for team contracts	----	----	----
b) Database of local experts	----	----	----
6. Marketing			
a) Assistance in market research	----	----	----
b) Promotion services	----	----	----
7. Finance			
a) Consultation in grant applications, loans, going public, etc.	----	----	----

Please prioritize your interest for the seven service areas described above (number them 1 through 7):

_____	S/W Development and Productivity Tools	_____	Staffing
_____	Training	_____	Marketing
_____	Access to Technology	_____	Finance
_____	Consultation		

Would you be interested in seconding one of your employees to the SPC?

a) Salary paid by SPC	YES	NO
b) Salary paid by your organization	YES	NO

Do you have any other suggestions or comments (use space below)?

Thank you very much for your help and patience.

APPENDIX B

One-off Ssystem Developer/System Integrator

MDA (*), MPR (*), Sierra (*), Westec (*), B.C. Systems corp. (*), Digital Dispatch Systems (*), Dynapro (*), Capilano Computer (*), Fain Boradale Computing, ND Systems, Mac Blo.

Software Product Developers

MDA (*), MRP (*), Krieger, Pamap (*), Richmond Software (*), Capilano Software, Resort Systems Inc., Chancery (*), Pathfinder, Osler Systems, Softset (*), Distinctive Management group (DMG) (*).

Embedded Software Systems Manufacturers

MPR (*), MDA (*), MDI (*), EPIC (*), Glenayre (*), ALI (*), Dynapro (*), Kustom Electronics (*).

MIS (internal)

MPR (*), MDA (*), Sierra (*), B.C. Tel (*), Mac Blo.

(*) = selected for survey

APPENDIX C

SIZE

ACTIVITY

	0-9	10-39	40-149	150+
SI		Pamap	DSI MDI	MDA MPR Sierra
PD	Richmond s/w Softset Quilchena	Pamap Chancery	DMG	MDA MPR
ES		DDS Kustom	Glenayre MDI DSI Epic	MDA MPR
MIS			BCSYS	BC Tel Westec

SOFTWARE ENGINEERING SURVEY

COMP. ID	S/W STAFF	YES	ASSEMBL	TOOLS	TRAINING	TECHNO	CONSUL	STAFF	MKTG	FIN
1	150	20	11	4	1	5	6	3	2	7
2	300	23	2	5	2	3	1	4	6	7
3	160	33	1	4	5	3	6	1	2	7
4	350	27	1	1	6	2	4	3	5	7
5	210	33	1	4	3	2	6	5	1	7
AVERAGES	234.0	28.4	3.2	3.6	3.4	3.0	4.6	3.2	3.2	7.0
BASE 100		81.14%		48.6	51.4	57.1	34.3	54.3	54.3	0.0
6	80	22	15	1	2	3	4	5	6	7
7	100	22	5	1	2	5	4	3	6	7
8	50	33	15	3	1	2	4	7	6	5
9	45	24	3	1	2	4	7	5	6	3
10	74	24	20	6	2	1	5	3	7	4
AVERAGES	69.8	25.0	11.6	2.4	1.8	3.0	4.8	4.6	6.2	5.2
		71.43%		65.7	74.3	57.1	31.4	34.3	11.4	25.7
11	15	26	10	5	4	6	7	3	1	2
12	10	24	5	2	5	3	1	6	7	4
13	10	28	0	6	1	5	7	3	2	4
14	20	19	30	2	1	6	7	3	4	5
AVERAGES	13.8	24.3	11.3	3.8	2.8	5.0	5.5	3.8	3.5	3.8
		69.29%		46.4	60.7	28.6	21.4	46.4	50.0	46.4
15	6	15	5	1	2	5	6	7	4	3
16	3	11	20	5	2	6	1	7	3	4
17	4	22	0	3	6	4	5	7	2	1
AVERAGES	4.3	16.0	8.3	3.0	3.3	5.0	4.0	7.0	3.0	2.7
		45.71%		57.1	52.4	28.6	42.9	0.0	57.1	61.9
TOTAL RANKING:	93.4	24.2	8.5	3.2	2.8	3.8	4.8	4.4	4.1	4.9
PERCENTAGE:		69.24%		54.6	60.5	45.4	31.9	37.0	41.2	29.4

References

[HUMP,87] Humphrey, W.S.,Sweet, W.L.; "A Method for Assessing the Software Engineering Capability of Contractors", Technical Report CMU/SEI-87-TR-23, Software Engineering Institute, Carnegie Mellon University, Pittsburg, Penn., 1987.

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[HUMP, 89] Humphrey,W.S., "TheSoftware Engineering Process: Definition and Scope"; Proceedings of the 4th International Process Workshop, Washington, D.C., IEEE Computer Society, 1989.